Evidence for *Pythium* as a Pathogen of Direct-Drilled Wheat in the Pacific Northwest

R. J. COOK, J. W. SITTON, and J. T. WALDHER, Research Plant Pathologist and Agricultural Research Technicians, respectively, USDA, SEA, AR, Washington State University, Pullman 99164

ABSTRACT

COOK, R. J., J. W. SITTON, and J. T. WALDHER. 1980. Evidence for Pythium as a pathogen of direct-drilled wheat in the Pacific Northwest. Plant Disease 64:102-103.

The problem of poor growth of wheat sown directly into undisturbed soil and stubble was eliminated and yields were increased about 40% with either methyl bromide fumigation or an in-furrow application of a granular formulation of *N*-(2,6-dimethylphenyl)-*N*-(methoxyacetyl)-alanine methyl ester (CGA 48988). The latter compound is specific for *Pythium* spp. and closely related fungi. *Pythium ultimum* was recovered from more than 50% of the plants in nontreated plots.

Additional key words: chemical control, no-till

In eastern Washington and adjacent Idaho, wheat (*Triticum aestivum* L.) seeded directly into undisturbed soil and stubble (direct-drilled) for erosion control may fail to emerge, may emerge but die during the winter or early spring, or may survive but tiller poorly and remain stunted. Often no lesions are evident on the main roots, but *Pythium ultimum* Trow can be recovered by plating on selective or other media.

Washington State University College of Agriculture Research Center Scientific Paper SP 5319.

Mention of a trademark or proprietary product does not constitute guarantee or warranty of the product by the USDA and does not imply its approval to the exclusion of other products that also may be suitable.

Accepted for publication 9 March 1979.

MATERIALS AND METHODS

To test whether one or more *Pythium* spp. caused the damage, we applied *N*-(2,6-dimethylphenyl)-*N*- (methoxyacetyl)-alanine methyl ester (CGA 48988), a compound specific for certain phycomycetous plant pathogens. The entire plot area was 6.3 m wide and 20 m long on land that had been cropped the previous year to wheat (harvested in August 1977). Both ends of the plot (6.3 m of each end) were fumigated with methyl bromide (MB) on 5 October 1977 to provide pathogen-free checks. This left an area (6.3 × 6.3 m) in the center of the plot to test the fungicide. A trench was dug around the periphery of two areas (6.3 × 6.3 m each), and a 3-mil plastic tarp was spread over the soil surface and the edges buried in the trenches. MB was then introduced under the tarp through rubber tubing at about 50 g/m^2. The tarp was removed on 7 October.

Nugaines winter wheat was direct-sown into the plot on 13 October, using a John Deere HZ deep-furrow drill. Sixteen rows 40 cm apart were planted the full length of the plot. The fungicide was applied into the rows as 5G (5% granular) on 17 October (4 days after seeding), using a Planet Junior push-type seeder, with the shoe maintained 1–2 cm deep (fungicide applied 1–2 cm above the seed). Mixing dry soil with the fungicide in the planter box allowed us to work with a larger quantity of material and facilitated uniform application. We applied about 30–50 mg a.i./m row. Fungicide was applied to every other pair of rows in the nonfumigated center portions of the plot. This provided eight adjacent comparisons of rows with and without fungicide. In addition, each treated and nontreated row could be compared on both ends with corresponding rows in fumigated soil. Plant stands, tillers with heads, plant height, and yield were determined.

RESULTS AND DISCUSSION

No seedling blight or plant stunting was evident in rows where soil had been treated with either MB or CGA 48988 (Table 1). Both treatments increased yields by more than 1,000 kg/ha (40%). Of the phycomycetous plant pathogens controlled by CGA 48988, *Pythium* is the most likely species to explain this response.

Isolations from roots and stems of wheat plants from nontreated plots yielded *P. ultimum*. We recovered no cultures of *P. arrhenomanes*, *P. graminicolum*, *P. aristosporum*, or *P. iwayamai*, also pathogens of wheat (2,4), but our tests were only preliminary. *P. ultimum* either is superficial on the root surface or is present mainly in the fine rootlets, as suggested by Bruehl (1) for *Pythium* on barley roots in South Dakota. The latter possibility seems most likely, since the systemic fungicide is presumably inside the plant and must act against the pathogen during or shortly after its entry into the plant.

No-till generally results in more soil moisture nearer the surface, and the soil is slower to warm in the spring. This, together with evidence that *Pythium* may use crop residue as a food base to attack the next crop (3), might explain why damage on wheat is greatest with no-till. *Pythium* root rot is apparently an important component of the numerous problems associated with direct-drilled wheat.

Table 1. Influence of soil treatments with methyl bromide or CGA 48988 (specific for *Pythium* spp. and related fungi) on growth and yield of direct-drilled winter wheat

Treatments[a]	Plants[b] (no./m)	Tillers with heads[c] (no./m)	Height[d] (cm)	Yield (kg/ha)
Check	11.6 ± 3.6	167.0 ± 44.0	77.7 ± 7.4	3,924
Methyl bromide				
Block 1	25.8 ± 5.5	250.7 ± 11.9	83.0 ± 5.8	5,040
Block 2	28.2 ± 3.5	264.2 ± 24.8	85.2 ± 5.5	5,587
CGA 48988	21.4 ± 2.5	248.0 ± 31.0	80.9 ± 6.7	5,567

[a] Two blocks, each 6.3 × 6.3 m, were fumigated with methyl bromide. A nonfumigated area 6.3 × 6.3 m was left between the two fumigated blocks for rows with and without fungicide. Sixteen rows of wheat were seeded without prior soil tillage in each block. Of the 16 rows in the nonfumigated area, eight received fungicide and eight were nontreated checks.

[b] Average counts and confidence intervals for three 0.5-m lengths of each of eight rows on 20 April 1978.

[c] Average counts and confidence intervals for 1-m length of each of eight rows on 28 June 1978.

[d] Average measurements and confidence intervals for five readings at random locations in each of eight rows on 5 July 1978.

ACKNOWLEDGMENTS

We wish to thank G. W. Bruehl and P. E. Lipps for helpful advice.

LITERATURE CITED

1. BRUEHL, G. W. 1951. Root rot in cereals and grasses. S.D. Farm Home Res. 2:76-79.
2. LIPPS, P. E., and G. W. BRUEHL. 1978. Snow rot of winter wheat in Washington. Phytopathology 68:1120-1127.
3. TRUJILLO, E. E., and R. B. HINE. 1965. The role of papaya residues in papaya root rot caused by Pythium aphanidermatum and Phytophthora parasitica. Phytopathology 55:1293-1298.
4. VANTERPOOL, T. C. 1938. Some Pythium species parasitic on wheat in Canada and England. Ann. Appl. Biol. 25:528-543.